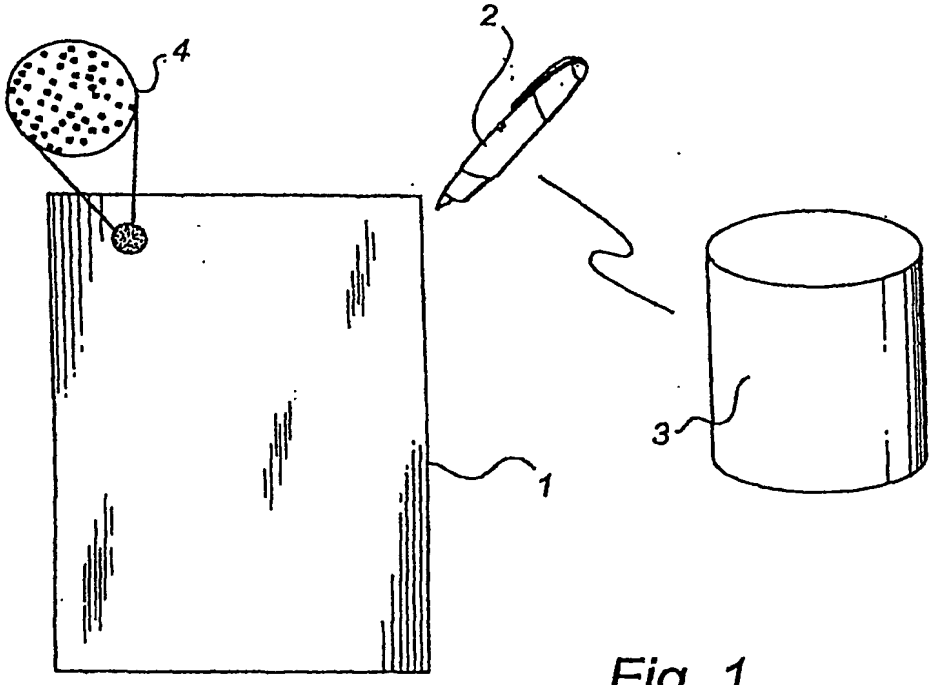


Fig. 1

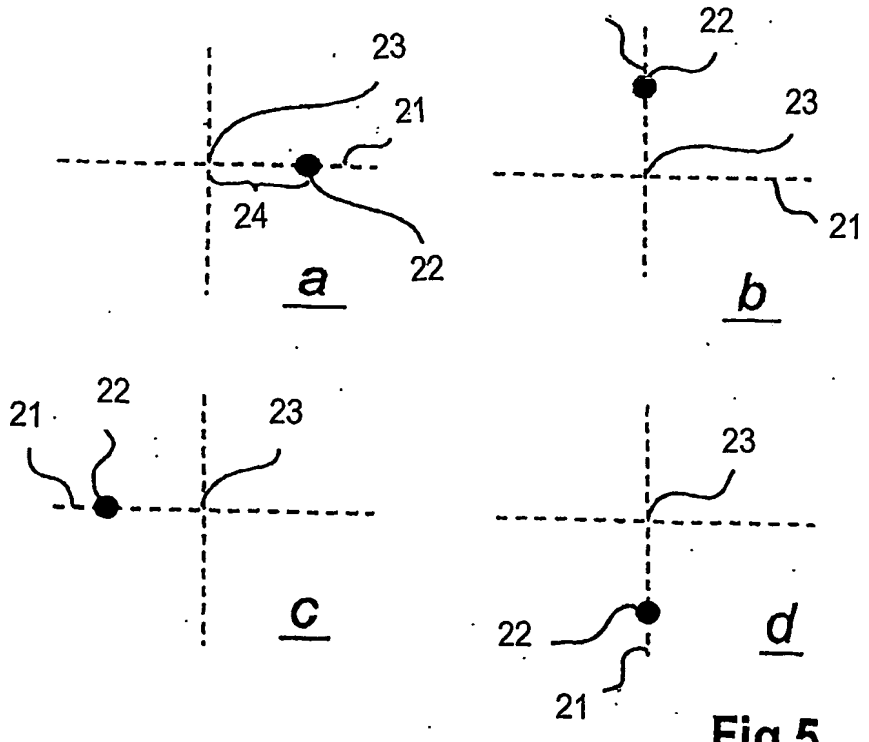


Fig 5

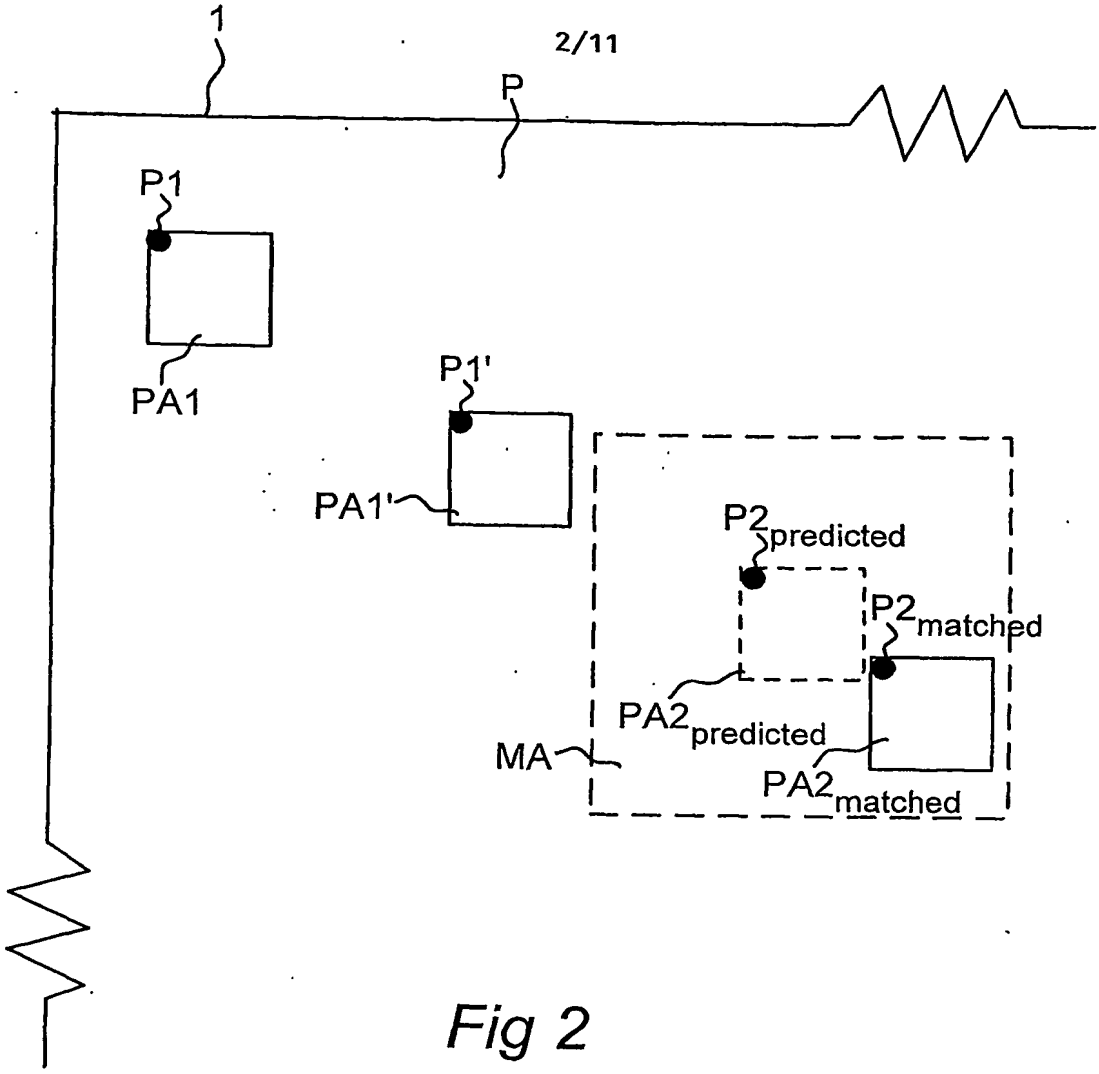

1
P
P1
PA1
P1'
PA1'
P2predicted
P2matched
PA2predicted
MA
PA2matched

Fig 2

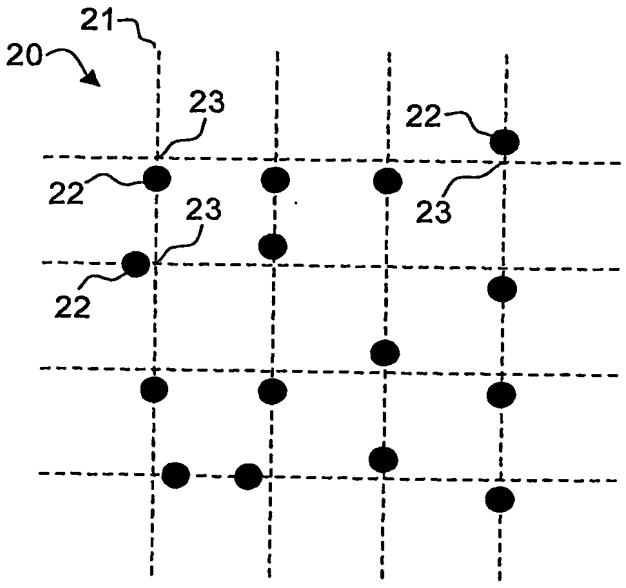

21
20
23
22
22
23
23
22

Fig 4

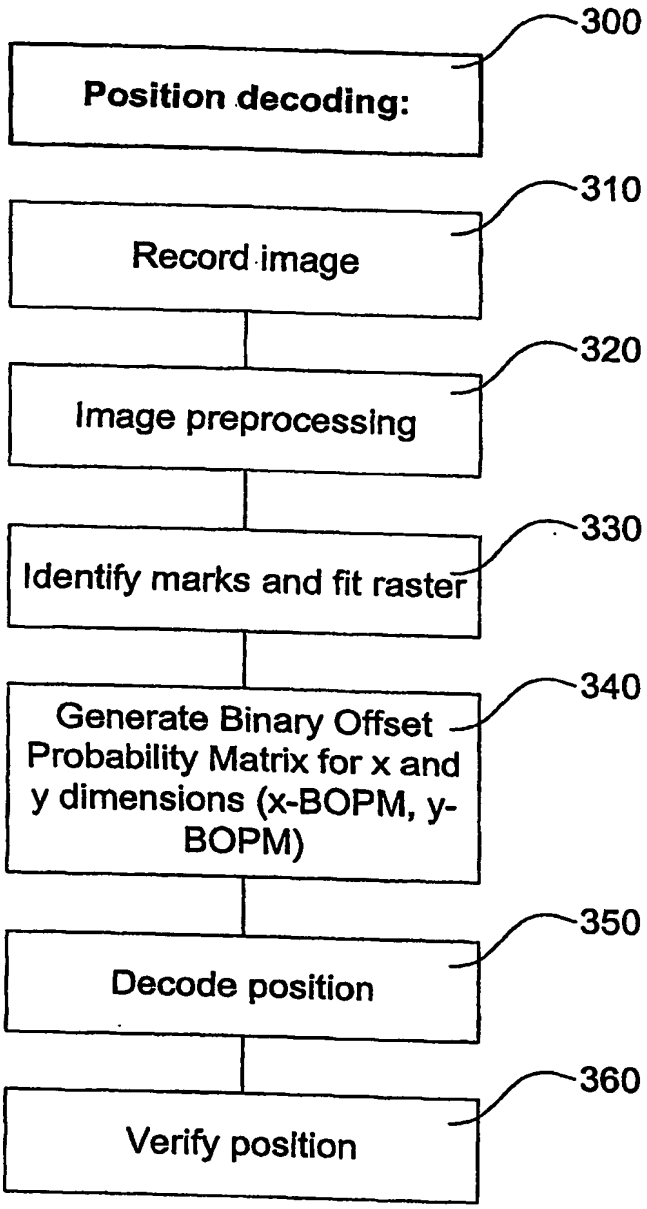

300
Position decoding:
310
Record image
320
Image preprocessing
330
Identify marks and fit raster
340
Generate Binary Offset Probability Matrix for x and y dimensions (x-BOPM, y-BOPM)
350
Decode position
360
Verify position

Fig 3

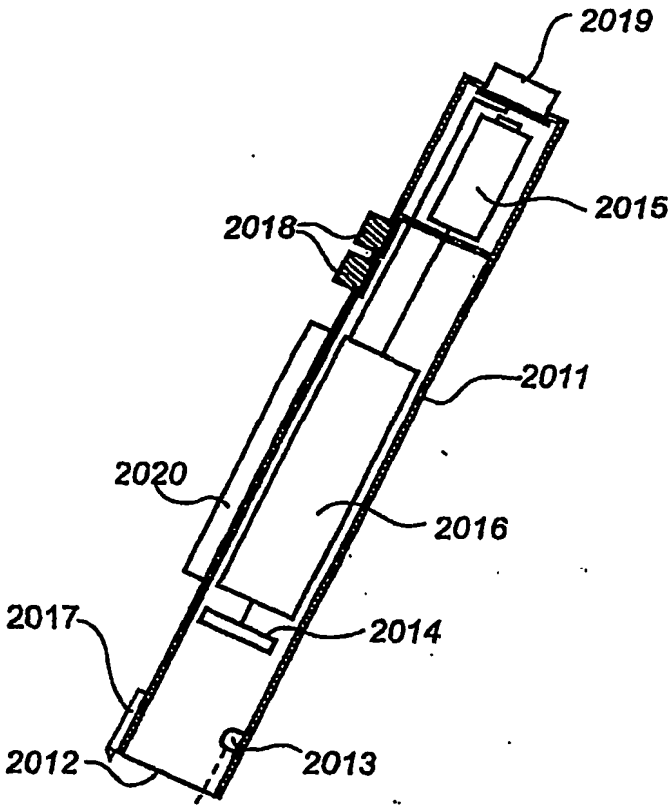


Fig 6

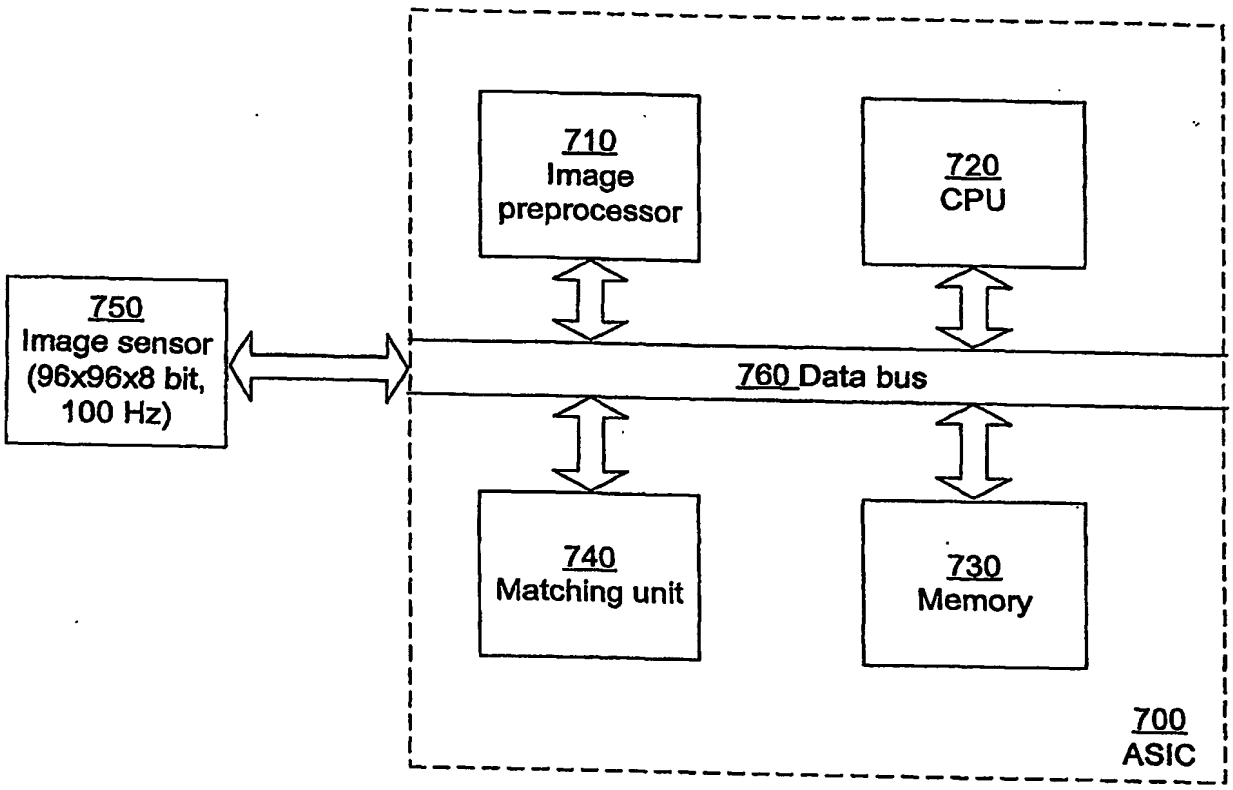
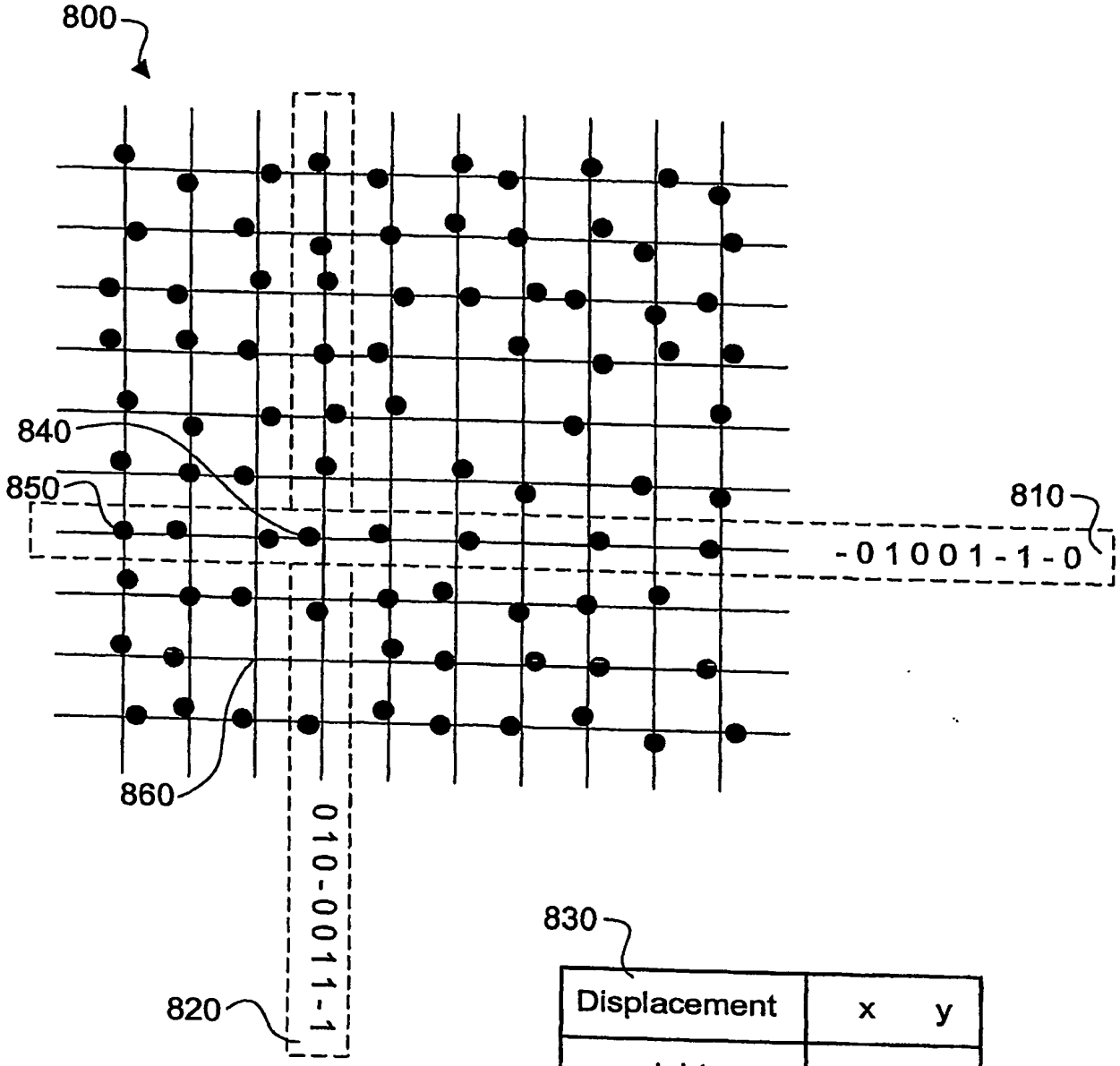

710
Image
preprocessor
720
CPU
750
Image sensor
(96x96x8 bit,
100 Hz)
760 Data bus
740
Matching unit
730
Memory
700
ASIC

Fig 7



Displacement	x	y
right	0	1
upwards	0	0
left	1	0
downwards	1	1

Fig 8

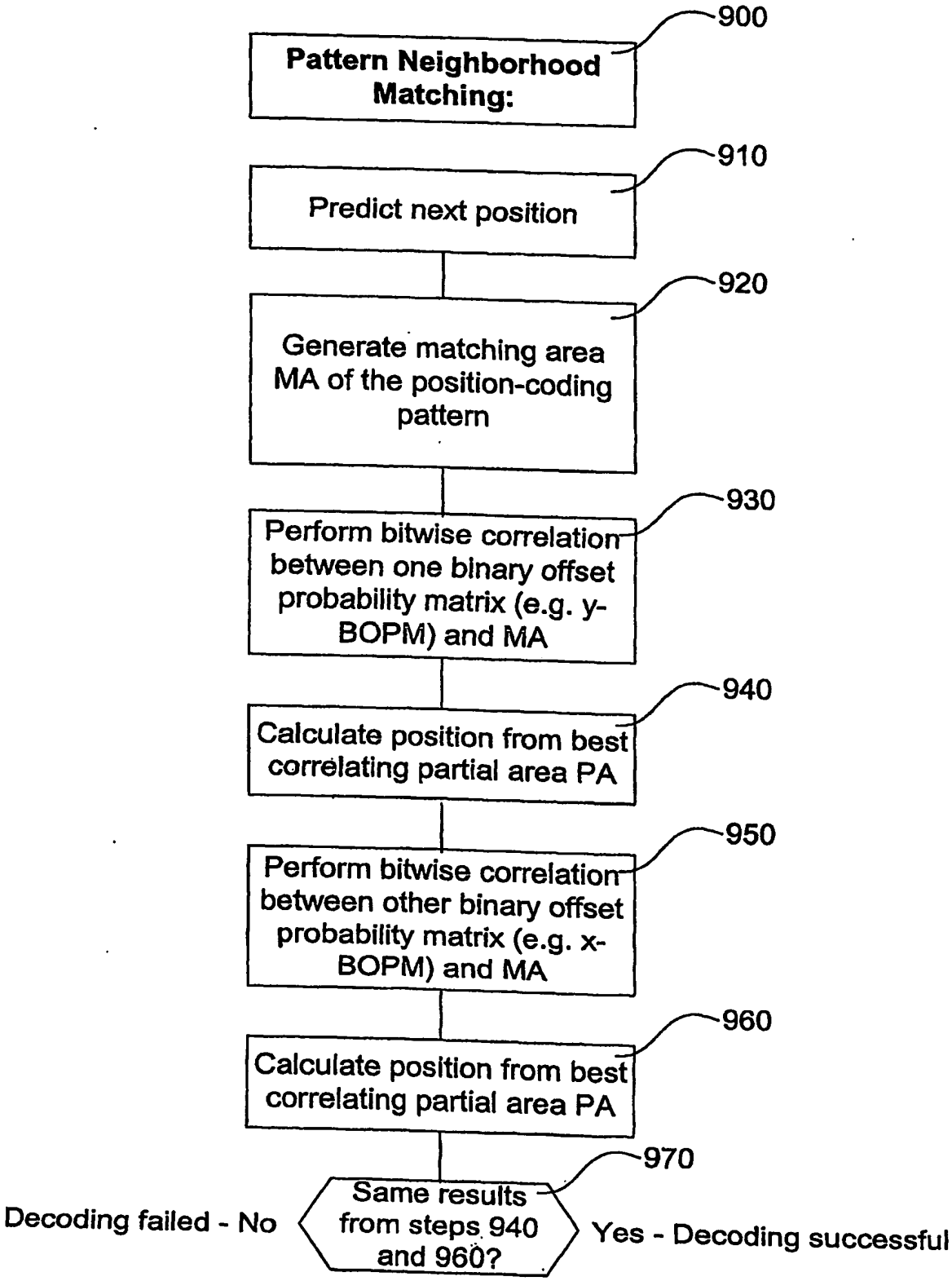
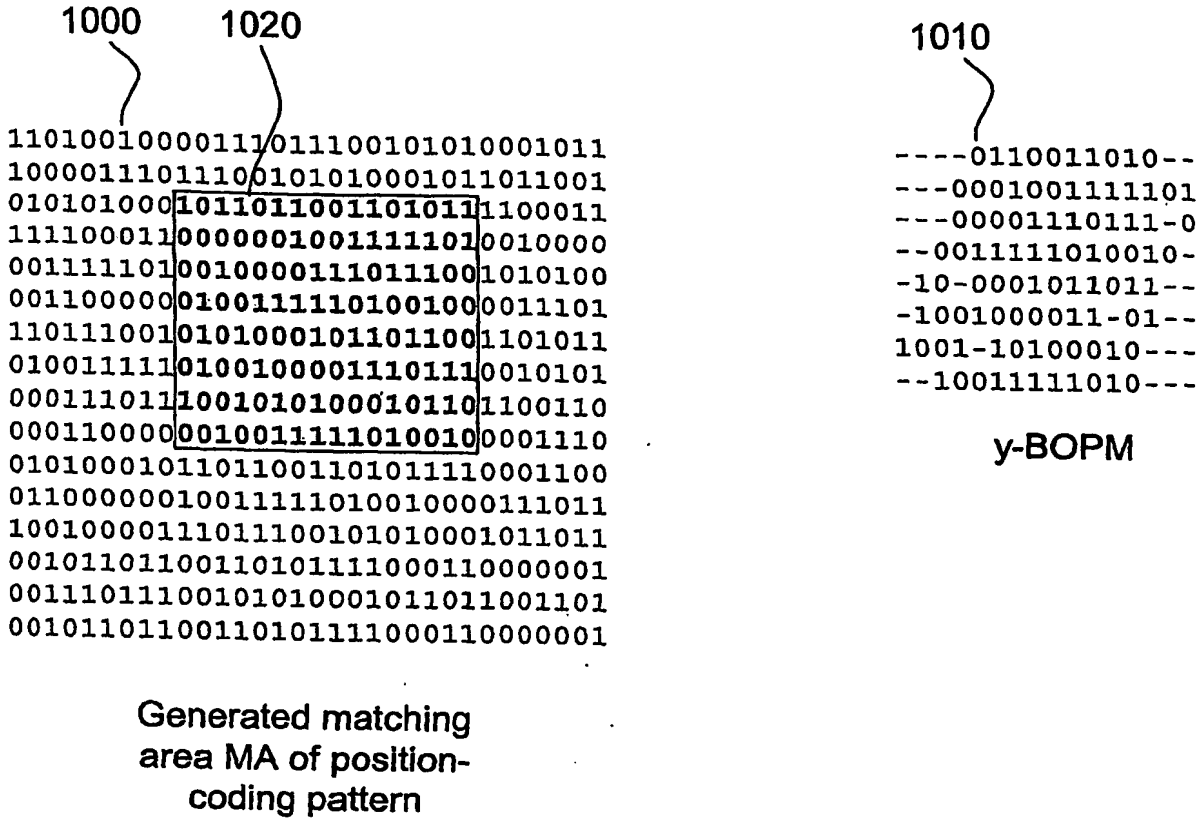

900
Pattern Neighborhood Matching:
910
Predict next position
920
Generate matching area MA of the position-coding pattern
930
Perform bitwise correlation between one binary offset probability matrix (e.g. y-BOPM) and MA
940
Calculate position from best correlating partial area PA
950
Perform bitwise correlation between other binary offset probability matrix (e.g. x-BOPM) and MA
960
Calculate position from best correlating partial area PA
970
Same results from steps 940 and 960?
Decoding failed - No
Yes - Decoding successful

Fig 9



Generated matching area MA of position-coding pattern

Fig 10

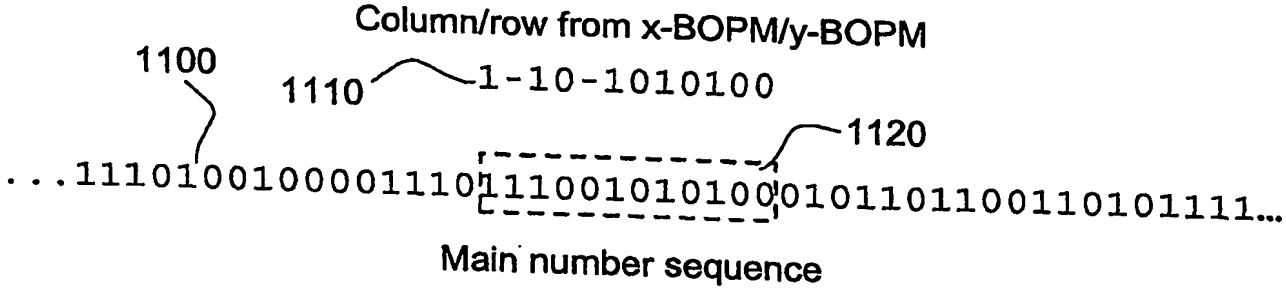

Column/row from x-BOPM/y-BOPM
1100
1110
1-10-1010100
1120
...11101001000011101110010101000101101100110101111...
Main number sequence

Fig 11

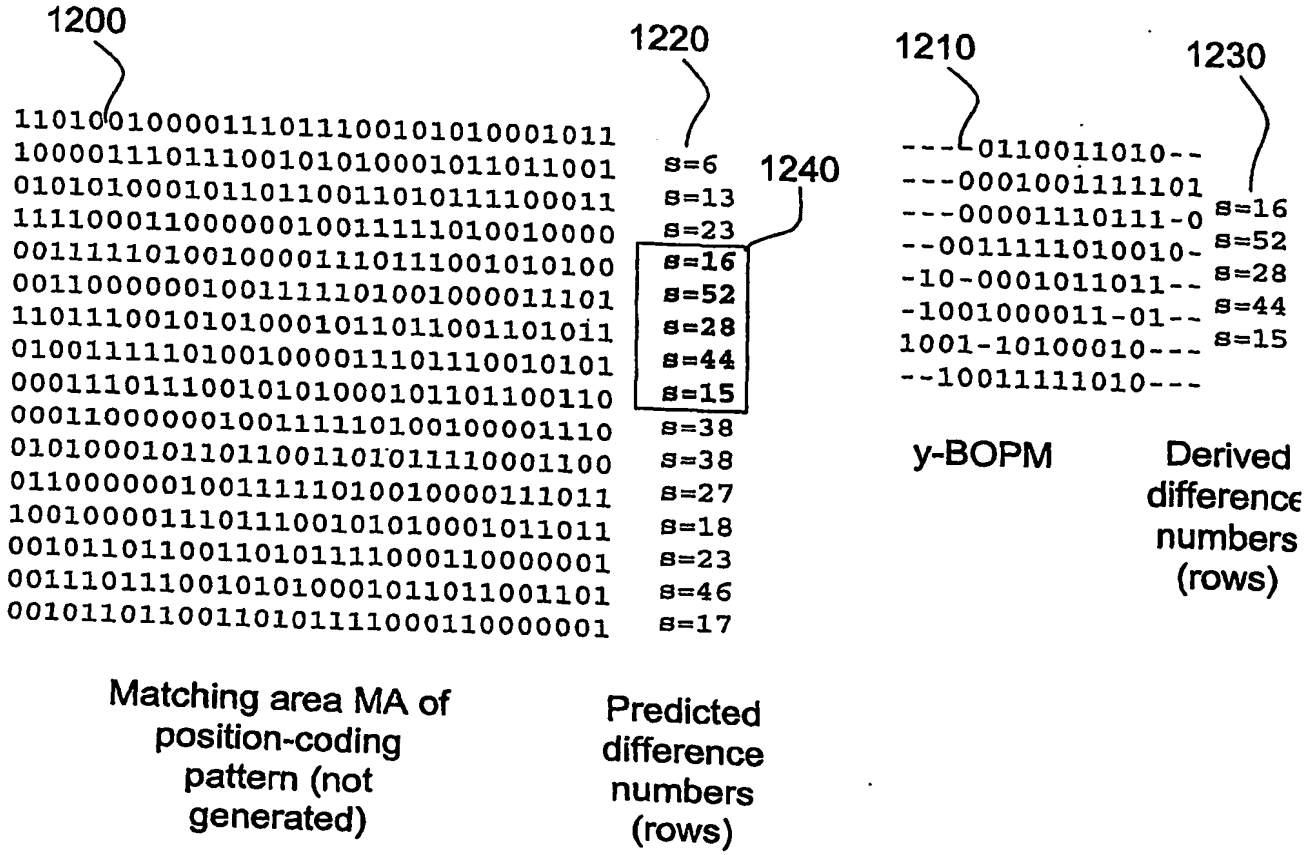

1200
1220
1210
1230
1240
11010010000111011100101010001011
10000111011100101010001011011001
01010100010110110011010111100011
11110001100000010011111010010000
00111111010010000111011001010100
00110000001001111101001000011101
11011100101010001011011001101011
01001111101001000011101110010101
00011101110010101000101101100110
00011000000100111111010010000111 0
01010001011011001101011110001100
01100000010011111010010000111011
10010000111011100101010001011011
00101101100110101111000110000001
00111011100101010001011011001101
00101101100110101111000110000001
s=6
s=13
s=23
s=16
s=52
s=28
s=44
s=15
s=38
s=38
s=27
s=18
s=23
s=46
s=17
---0110011010--
---0001001111101
---00001110111-0
--0011111010010-
-10-0001011011--
-1001000011-01--
1001-10100010---
--10011111010---
s=16
s=52
s=28
s=44
s=15
Matching area MA of position-coding pattern (not generated)
Predicted difference numbers (rows)
y-BOPM
Derived difference numbers (rows)

Fig 12

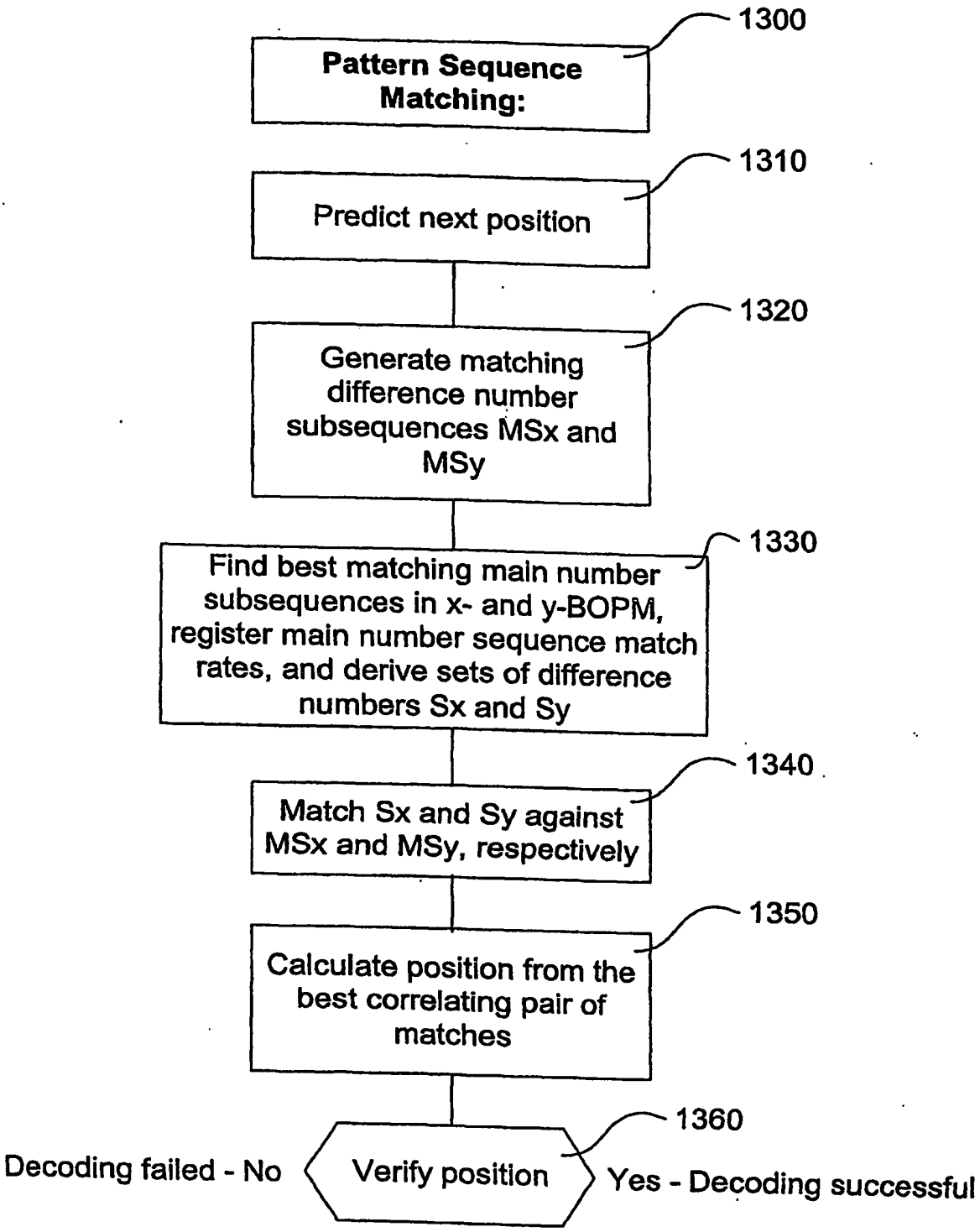

1300
Pattern Sequence Matching:
1310
Predict next position
1320
Generate matching difference number subsequences MSx and MSy
1330
Find best matching main number subsequences in x- and y-BOPM, register main number sequence match rates, and derive sets of difference numbers Sx and Sy
1340
Match Sx and Sy against MSx and MSy, respectively
1350
Calculate position from the best correlating pair of matches
1360
Verify position
Decoding failed - No
Yes - Decoding successful

Fig 13

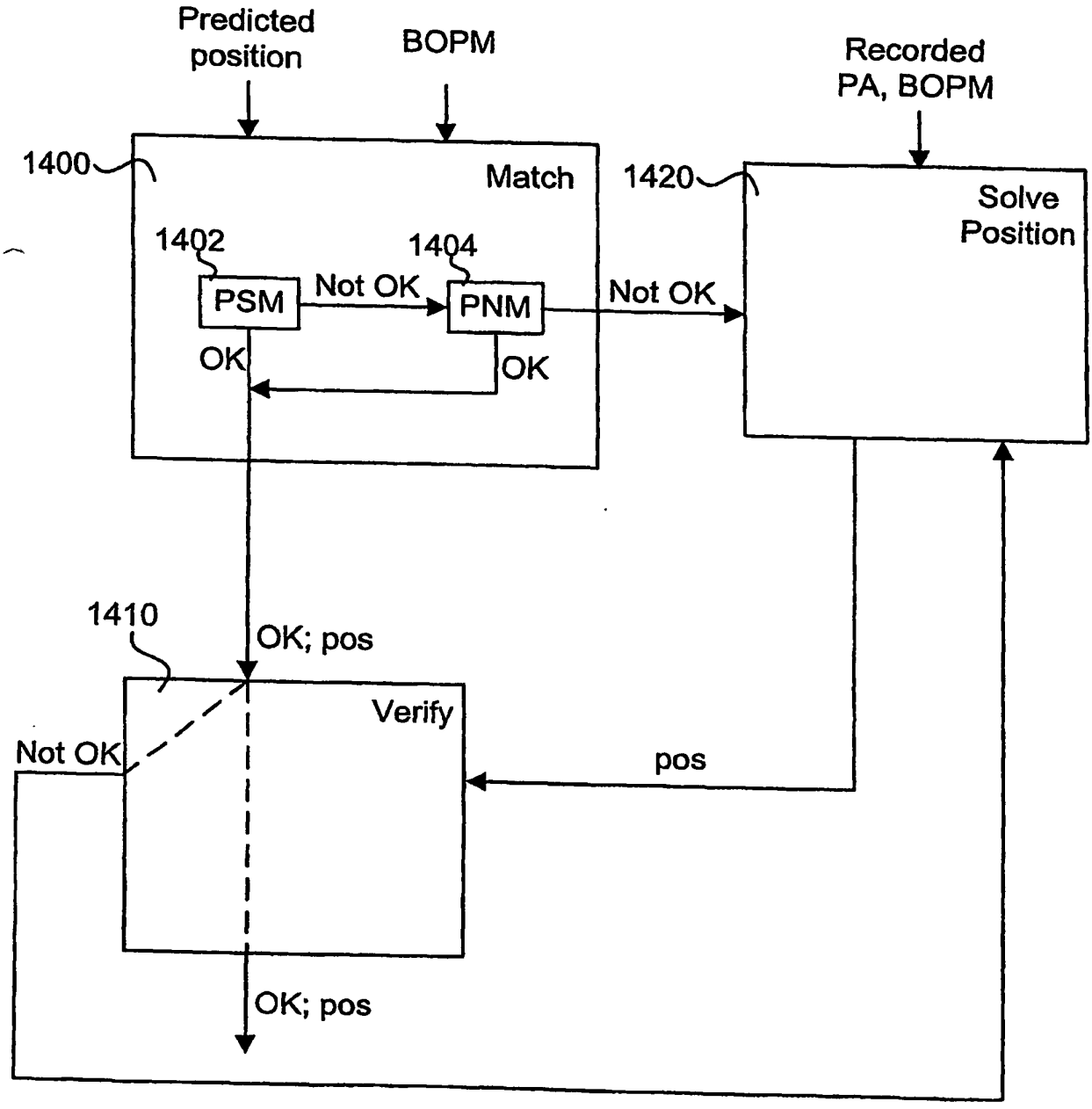

Predicted position
BOPM
Recorded PA, BOPM
1400
Match
1420
Solve Position
1402
1404
PSM
Not OK
PNM
Not OK
OK
OK
1410
OK; pos
Verify
Not OK
pos
OK; pos

Fig 14